Report of a Geological and Topographical Survey of Marion County, Indiana,

Made Under the Direction of Prof. JOHN COLLETT, Chief of the Department of Geology and Natural History.

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GEOGRAPHICAL AND HISTORICAL NOTES.

Marion is the central county of Indiana. It is bounded on the north by Hamilton and Boone counties, on the east by Shelby and Hancock, on the south by Johnson and Morgan, and on the west by Hendricks. It comprises an area of 400 square miles. The county was organized by an act of the Legislature approved the last day of the year 1821, and the territory now comprising the counties of Hamilton, Boone, Madison and Hancock was attached to it for judicial purposes. On the first Monday in April, 1822, an election for county officers was held, at which 336 votes were cast. At the first meeting of the County Commissioners an appropriation of $8,000 was made to erect a court house of brick, at least fifty feet square, the use of which was tendered to the State for the sessions of the Supreme Court and Legislature, for the period of fifty years, or until a State House should be built.

The territory of Marion county was originally the property of the Delaware tribe of Indians, and was ceded to the United States by the treaty of St. Mary's in 1818; with the stipulation that the land should not be sold before 1820. In that year the government surveys were made, and in the month of October the land was offered for sale. By the act of Congress admit-

ting Indiana into the Union, approved April 19th, 1816, four sections of unsold land were donated to the State for a permanent capital. The Legislature of the State at its session in 1820, appointed ten commissioners to locate this land—the future Capital City of the State. Five of these commissioners accepted the appointment, and after a careful examination of several points, they located the donation on White river at the mouth of Fall Creek. The selection was confirmed by the Legislature in January, 1821, and the prospective city was named

INDIANAPOLIS,

(A compound of English and Greek—Indiana, English for the State, and Polis, Greek for city), at the suggestion of Judge Jeremiah Sullivan, of Jefferson county. Early in the spring of 1820, George Pogue, John McCormick and his brother, James McCormick, built and inhabited cabins on what was afterwards selected as the government donation, and prior to the location of the capital in June of that year, several other pioneers had joined them. Christopher Harrison, James Jones and Samuel P. Booker were appointed Commissioners to make a plat of the town and survey the streets and lots. These Commissioners intrusted the work to Judge Harrison, who employed Alexander Ralston and Elias P. Fordman surveyors. Ralston has the credit of drafting the original plat, and to him Indianapolis is indebted for her wide streets and convenient diagonal avenues. A square mile was surveyed near the center of the donation, and this was divided into four equal parts by Meridian street running north and south, and Market street east and west. At the intersection of these, a circle 400 feet in diameter was laid off, designed for the Governor's residence. From this circle broad avenues extended to the four corners of the square mile, and streets running towards the cardinal points divided the plat into squares 420 feet on each side. That portion of the original donation lying outside of this plat was divided into large outlots intended for suburban residences. The first sale of lots took place on the 10th of October, 1821, and was continued from day to day till 314 lots were disposed of, realizing the sum of $35,596.

On the 7th of March, 1822, a postoffice was established at the new capital and an eastern and southern mail route was opened. On the 28th day of January, 1822, George Smith and Nathaniel Bolton issued the first number of the "Indianapolis Gazette," and a year later Harvey Gregg and Douglass McGuire commenced the publication of the "Western Censor." In November, 1824, the archives of the State were removed from Corydon to Indianapolis, and it became the permanent capital of the State. From that date but few inland cities have advanced as rapidly in population, in wealth and in commercial and manufacturing importance. This has been generally attributed to its geographical situation in the middle of one of the most fertile plains of the great West, enjoying a climate equally removed from the tropical summers of the Southern States and from the arctic winters of the Northern. But it is doubtful if these conditions have contributed more to its prosperity than have its remarkable topographical and geological surroundings, which we will proceed to notice.

TOPOGRAPHY.

Marion county may be regarded as part of a great plain, yet there is but a very small part of it that is actually level. The county is divided by the broad valley of White river. This valley, in its general direction, has a bearing of about 20 degrees east of north and west of south, and varies from one to four or more miles in width. On its west side it presents, in the greater part of its course, an abrupt bluff, ranging from 50 to 200 feet high. On the east side the descent from the elevated table land to the White river valley is generally a long, gentle slope. The average elevation of this plain above low water in the river is about 175 feet, or 860 feet above tide water. Occasionally, however, the elevation above the river exceeds 200 feet. These slight diversities of elevation give a pleasing variety to the landscape, where the forest is cleared away, that was not apparent in its primitive state. The drainage of this plain is effected on the east side of White river by Fall creek and its tributaries, Pogue's Run, Pleasant Run, Lick creek and Buck creek, and on the west side of the river by Williams creek, Eagle creek and its tributaries, and by Dollar-

hide creek. A water shed, dividing the tributaries of the east and west White rivers, enters the county from the south, about two miles west from the southeast corner, and bearing nearly due north for a distance of twelve miles, where it makes a detour to the east and passes out of the county. Water sheds in this region are not high ridges, as in most countries. On the contrary, these divides are generally marshy, and in time of heavy rains, are often flooded with water. It is here that the streams have their sources, and, subdividing, they often degenerate into sloughs, and sometimes into broad swamps. These, however, being on the highest lands, are always susceptible of drainage, when they become a superior quality of farming lands.

White Lick, a large stream that has its rise in Boone county, and flowing southwardly, nearly parallel with the western line of Marion county, empties into White river in Morgan county. This accounts for the few streams flowing into White river from the west. The valley of White river is divided into alluvium, or bottom land proper, and the terrace or second bottom. In that portion of the valley that lies north of the mouth of Eagle creek it consists chiefly of second bottom, while the first bottom largely predominates in the southern portion of the valley. Much of this is subject to overflow in times of freshets. While these lands are exceedingly fertile and easy of cultivation, yet a crop is never safe on them.

To remedy this defect, several miles of levee have been made, but with only partial success. There is a geological reason which may conduce somewhat to this overflow, (which we will notice in its proper place) but the immediate cause is the tortuous course of the stream. From Indianapolis to the point where the river crosses the county line is nine miles, on a direct line; but following the meanders of the stream the distance is about sixteen miles. This not only diminishes the fall, per mile, but the water being compelled to move in curves and reversed curves, wastes its momentum, the current becomes sluggish, the water accumulates and overflows the low banks and inundates large districts of farm lands. If a new channel could be formed, as nearly on a straight line as practicable, the current would be rapid, and as the formation is chiefly sand, it would soon cut itself deep enough to secure most of the ground

against overflow. This would cost less than to levee the present stream in its crooked course, but it would require a concert of action among the land owners; and worse than that, it would divide farms, leaving part on one side and the remainder on the other. Unfortunately, White river was considered a navigable stream, at which the original surveys terminated on each side, and the fractions were numbered accordingly. To change the bed of the stream would confuse these numbers, and might unsettle land titles; and yet it appears to be the only practical method of controlling the river in times of freshets.

The glacial action which left a heavy deposit of transported material over the whole surface of the county, has at the same time plowed out several broad valleys of erosion which appear to be tributary to the White River Valley. The best marked of these, come down from the northeast between Fall Creek and White River. It is about a mile wide at its lower end and narrows to the northeast for six or seven miles, disappearing near the northern line of the county. The erosion has cut away the surface clay and, in places, filled the excavation with gravel and coarse sand. On the west side of the river a remarkable glacial valley begins near the northwest corner of Morgan county and proceeds eastward, north 20°, a few miles south of the north line of that county, crossing White Lick a mile north of Mooresville, and, entering Marion county, it passes between West Newton and Valley Mills, joining White River Valley near the mouth of Dollarhide creek.

Another glacial valley, nearly a mile wide, extends from White river, at a point a little north of Glen's Valley, bearing northeast for a distance of about five miles. The margins of this valley are very well defined on each side, being composed chiefly of gravel terraces. South of this, lying chiefly in Johnson county, is another broad and deep valley of erosion. Between these two a narrow ridge rises to the height of one hundred feet above the level of the river. This has long been known by the local name of Poplar Hill. It is composed of sand and gravel resting on a solid basis of blue clay.

GEOLOGY.

Marion county rests on three distinct geological members, two of them belonging to the Devonian formation and one to the Carboniferous; though neither of these show themselves conspicuously on the surface. Over these lies a deposit of drift, or transported material, from fifty to one hundred and fifty feet thick. This forms the surface of the country and moulds its general configuration. However, the underlying rock exerts some influence on the face of the county, notwithstanding the depth of its drift covering. This is most apparent along the line where the Knob sandstone overlaps the Genessee shale. The line of strike dividing the geological members traverses the county on a line from the south, bearing about 30° west of north. This line, as it divides the Corniferous limestone from the Genessee shale (black slate) passes between this city and the Hospital for the Insane. Borings in the city reach the limestone at a depth of from sixty to one hundred feet, it being the first rock, in place, encountered; but at the Hospital forty feet of shale was passed through before reaching the limestone. This gives the eastern portion of the county as resting on the Corniferous limestone, and the western on the Delphi black slate, technically known as the Genessee shale. Under a few square miles in the southwestern corner of the county the Knob sandstone (Carboniferous) will be found covering the slate. A short distance north of the Johnson county line we observed, after a freshet, large pieces of slate thrown out on a sand-bar, indicating that the river had laid bare that rock at some point near by. This gives its characteristic level to the bed of White River in the lower half of its course through the county. But a short distance west of the western line of the county, streams tributary to White Lick lay bare the lower members of the Knob sandstone.

There is, therefore, but little risk in assuming that Sections 9, 16, 21 and 22, in Town 14, Range 2, are underlayed with this sandstone. There are indications both on Pogues' run and Pleasant run that the limestone is very near the bed of the stream, but it is not probable that stone quarries can ever be profitably worked in this county. The geological interest here

lies chiefly in the heavy deposits of transported material that so completely conceal the stratified rocks beneath.

These drift fields present problems to the geologist, much more difficult of solution than are those of the older rocks; but these great plains of the West will furnish the means of solving these problems, if they are ever to be solved. Elsewhere, these glacial agencies have cut down the hills and piled the eroded material in promiscuous masses in the valleys. The drift, therefore, is local, both in its origin and in its deposition; but the drift that covers our great western plain is foreign in its character and general in its deposition. Moreover, it is not a *promiscuous* deposit of clay, sand, water-worn pebbles and bowlders, as the eastern geologists describe their glacial drift to be. True, all these are found, but not without order of arrangement. Indeed, the drift of Marion county, as we have studied it, has nearly as much regularity and order as we generally find in the stratified rocks; and this is but a sample of the deposit that is spread over the northern sections of Ohio, Indiana and Illinois.

At the base of this formation we almost invariably find a heavy member of a very compact, lead colored clay, with but few bowlders, and these invariably composed of quartzite rocks, of highly metamorphosed sandstones, or of trap rocks. There may occur, occasionally, in this member, thin deposits of very fine gray or yellow sand, but these are not uniform. Between this clay and the underlying rock there is generally interposed a bed of coarse gravel or small siliceous bowlders, from three to six feet thick. In a few instances we have found this bed of gravel wanting—the clay resting firmly on the bed-rock. But this is exceptional and rarely occurs. This clay, in Marion county, ranges from twenty feet to more than a hundred feet thick, and, with the exceptions named, is very uniform in its character throughout. Chemically, it is an alumina silicate in a very fine state of division, and mechanically mixed, is an exceedingly fine sand which, under the microscope, appears to be fragments of nearly transparent quartz. It owes its color to a proto-sulphide of iron (*ferrous sulphide*). A careful analysis shows, also, a small per cent. of lime and potassa, and a trace of phosphoric acid.

Above this is generally found a few feet of coarse sand or

fine gravel, and resting on this lies twenty or thirty feet of a true glacial drift, having the promiscuous character of the glacial drift described by the eastern writers on this subject. In and on this we have large bowlders of granite, gneiss and trap rocks, which are not found *in situ* nearer than the shore of Lake Superior, from which region they have evidently been transported, as numerous scratches and grooves in exposed beds of rock over which these travelers have passed in their journey fully attest. In this same upper drift occur the gravel terraces that opportunely offer us the material for the best of roads, where no other material can be found. But the mass of this upper bed is a yellow or orange-colored clay, with quite a large mixture of sand and a sufficient quantity of lime to render the water that percolates through it hard. The number and size of the bowlders which lie on and near the surface in many localities is amazing, considering the distance of their transportation. On Section 6, in Township 15, Range 3, we measured a bowlder of granite, very closely resembling the Quincy, the dimensions of which were nine feet eight inches long, five feet wide, and four feet of it was above ground; how much below, we do not know.

A bowlder of the same character, and nearly of the same dimensions, lies near the northwest corner of section 15, in township 16, range 4. In a few localities in this county these bowlders are scattered so thickly as to interfere with cultivation. They may, however, be readily broken up by fire, or blasted into convenient stones for cellar walls, house foundations, etc. In the central and northern portions of the county, the bowlders are almost invariably granitic in their character, but along the southern border they are generally gneiss or trap rock.

The gravel terraces are generally found in a succession of mound-like elevations, rising from ten to fifty feet above the level of the surrounding plain, and are commonly found resting on a compact clay. They are frequently arranged in lines, bearing east, a little north, and west, a few degrees south. North of these gravel mounds we generally find a considerable space of level, and often swampy lands, indicating the position of a mass of ice, under which a torrent of water had rushed with great force, excavating the clay below, piling up the

heavier gravel and sand, and carrying the lighter clay and finer sand to be distributed over the country. When the ice disappeared, the excavation would be a miniature lake, to be ultimately filled up with the lighter and finer material borne from other terraces forming still further north.

The terrace formations, or "second bottoms," bordering the river on one side or the other, almost everywhere, have nearly the same character and history as the gravel beds of the uplands. They consist of deposits of gravel and coarse sand, resting on the lower blue clay, into which the river has cut its present channel. Formerly we considered these plains, frequently three or four miles wide, as lake-like expansions of the stream which had been silted up by its sediment; but an inspection of the material deposited shows that the water from which the deposit was made, was no quiet lake, but a current sufficiently strong to bear onward all lighter material, leaving only the heavier gravel and sand behind.

But the fact that these several deposits, which can be clearly traced to the last act of the great ice drama, all rest on the lower blue clay, clearly indicates the pre-existence of this deposit. Moreover, the specific character of this lower member of our drift formation points to the conditions under which it was deposited, as widely different from the rush and tumult of water consequent on a dissolving glacier, and yet it bears the unmistakable marks of deposition from water. The material is, most of it, exceedingly fine and could have been deposited only from very quiet waters, and its compactness and solidity attest the pressure of deep waters. That the glacial action, which has left its marks on the whole surface of our country, took place subsequent to this deposit is indicated by the fact that the small lakes of northern Indiana are excavations in this lower blue clay, made by undermining currents, beneath a dissolving glacier. Indeed, Lake Michigan, at its southern extremity, rests on this clay and is excavated into it, to an unknown depth. Another fact in relation to this lower drift member, has its significance.* At the bottom of this clay is frequently found the remains of a cone-bearing forest, probably cypress or hemlock. In this county, several wells that have been dug to the bottom of this clay, have exposed logs, from ten to fifteen inches in diameter, in a good state of preserva-

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vation. These are not broken nor crushed as they would have been under the advancing march of a mountain of ice.

The problem of this lower blue clay is one that remains yet to be solved. Indeed, its peculiar character and relations have not been observed and studied, as yet, with sufficient care to furnish reliable data for its solution. Moreover, the problem is one involving many and peculiar difficulties, chiefly owing to the absence of fossils of any description except the remains of an ancient forest, above alluded to. This is not the place, nor have we the time to discuss abstract scientific theories, but we may be allowed to hint that if the Age of Ice was preceded by an upheaval elevating the ground about the Arctic circle above the line of perpetual congelation, it would of necessity involve a corresponding depression south of that upheaval, thus creating a great fresh-water inland sea. The upheaval north and the depression here, though it may have consumed years in its completion, would have caused torrents of water, loaded with sediment, to rush in and fill up the constantly increasing depression. This sediment, as the waters became quiet, would be slowly precipitated. The evidence that these waters were originally charged with sulphurous gases from volcanic agencies, is preserved in the sulphur now combined with iron, giving color to the clay. This will account for the absence of life in this inland sea till the sediment was entirely deposited; after that the increasing cold would seal it over with an impervious crust of ice which would cut off access to the air and forbid the existence of life. At the close of the Ice age, when these conditions were reversed by the sinking of the northern elevation and the rising of the bed of the fresh-water sea, as well as by the dissolving of the mountains of ice, torrents of water would rush over the southern plains to the Gulf of Mexico, leaving the marks of denudation on the hills of Kentucky, Tennessee and Alabama, that are now so plainly visible, and furnishing much of the material that now forms the delta of the Mississippi.

But apart from theories and speculations, this clay serves several practical purposes which are of great economical value. When exposed to the atmospheric agencies for a few years it undergoes important chemical changes which make it the basis of a very productive soil. The action of frost breaks down and

destroys its adhesive quality, and it becomes a fine mass of crumbling, porous earth. The action of the oxygen of the air converts the sulphur into an acid, which, seizing on the potash and lime present, converts them into slowly soluble salts of these bases which furnish important mineral elements of fertility for years of cropping, needing only organic matter to make it available for immediate use. The fineness of the material makes it an excellent absorbent, and as such it might be profitably used in composting manures, retaining the ammonia as a sulphate.

But the practical importance of this bed of clay is that it acts as a filter, securing an inexhaustible supply of very pure water in the gravel and bowlders beneath it. In a country as level as Marion county is, and as productive of vegetation, the surface water must become charged with organic matter, which the porous upper beds of soil, clay and sand but imperfectly arrest, so that the water furnished by superficial springs and shallow wells, is seldom so free from organic matter as to make it fit for domestic uses. These soluble organic impurities are always increased in the vicinity of inhabited houses, and of stables and barns in use. They are not only increased in quantity, but intensified in their objectionable qualities by a large increase of animal matter, from unavoidable accumulation of excrementitious substances. The surface water, from rains and melting snows, is rapidly absorbed by the porous loam, and the facility with which it reaches a tile drain, three or four feet from the surface, suggests the possibility that it may contaminate the water of a well even twenty feet deep; and an analysis too often confirms this unpleasant suspicion. If this be true of country places, where farm houses are far apart, how shall we escape the contamination of our superficial wells in a city situated as Indianapolis is? As yet our population is not sufficiently dense to greatly impair the health of the city from this cause; but the supply of potable water is the great sanitary problem, not only of this and other cities, but of all the country located on this loose, porous, drift soil. Fortunately, the solution of this problem is found in the reservoir of filtered water held in the bed of gravel and bowlders lying below this perfect filter of blue clay. We may not know how that clay came

there, but we can know what beneficent purpose it serves. The water from this source is practically free from organic matter, but always contains iron in sufficient quantity to be perceptible by the taste, and to tinge vessels red that are used to contain it. This is a characteristic mark by which this lower water can be distinguished wherever found. The general dip of the underlying rock of this county being westward, and the blue clay being impervious, except by slow filtration, it follows that the lower water will rise to the level of its outlet, wherever that may be. The result of this is, that where natural fissures occur in the clay the water rises, and often overflows in natural artesian wells, that are known by the characteristic tinge which the water, in time, gives to everything it comes in contact with. These springs are constant in the quantity, quality and temperature of the water discharged. There are a number of these springs in Marion county, several of which are quite noted. As specimens of this class, we may name the Minnewa Spring, one and one-half miles northeast of the village of Lawrence, and the Fair-ground Spring, on the farm of John Brown, half a mile northwest of that village. These rise perpendicularly through the blue clay to the surface, where it is one hundred and eighty feet above the water in White river, at Indianapolis. A noted spring of this character breaks through the blue clay, at the foot of the river hill, on the farm of the late Demas McFarland, about a mile southwest of Maywood. But, perhaps, the largest of these springs in the county is on the farm of Fielding Beeler, on the Vincennes railroad, two miles from this city. It forms a wet prairie, or marsh, of several acres, from which, by ditching, a large stream of water is made to flow. These are generally, but improperly, known as Sulphur Springs.

This lower fountain has been reached by tube wells in a number of places in this city, and its immediate vicinity, which not only tests the quality of this water and its abundant supply, but gives us an opportunity to study the arrangement and relation of the different members of the drift formation in this county. We subjoin a few sections obtained from these borings:

1.—*At Butler University, Irvington.*

Above Indianapolis 119 feet.

Yellow clay and loam	18 ft.
Blue clay	18
Quicksand (water)	4
Blue clay	60
Coarse gravel (water)	8
Total	108 ft.

Here the water rose to the quicksand, forty feet from the surface.

2.—*On the Carter Farm.*

Section 14, range 3, township 16.

Loam and yellow clay, with occasional bowlders	20 ft.
Sand (water)	2
Blue clay, with gravel below (water)	60
Total	82 ft.

Water rises within twenty feet of the surface. This well is about ninety feet above low water in White river, opposite this point.

3.—*Well at Brightwood.*

Eighty-three feet above Union Depot.

Loam and yellow clay	22 ft.
Sand (water)	2
Blue clay	36
Fine sand (water)	3
Blue clay	40
Coarse gravel	4
Total	107 ft.

Water rising within twenty-five feet of surface.

4.—*Well in Garfield Park, City.*

Loam and yellow clay, with occasional bowlders	18 ft.
Sand (water)	2
Blue clay	60
Gravel (water)	2
Total	82 ft.

Water rises within eight feet of surface.

5.—*Well in University Park, City.*

Loam	3 ft.
Gravel to water	17
Gravel below water	20
Blue clay	25
Coarse gravel	2
Total	67 ft.

Water rising within twenty feet of surface.

6.—*Well at the Junction of St. Clair and Alabama Streets.*

Loam and clay	4 ft.
Gravel to water	16
Gravel below water	18
Blue clay	19
Quicksand (water)	4
Blue clay	14
Coarse gravel	2
Total	77 ft.

Water rising within twenty-four feet of surface.

7.—*Well in Circle Park, City.*

Gravel and sand (upper water)	61 ft.
Blue clay	9
Flint conglomerate	2
Coarse gravel (lower water)	16
Total	88 ft.

NOTE.—This "Flint conglomerate" consisted of Siliceous pebbles, or fragments of chert, cemented with lime.

8.—*Well at the Postoffice.*

Gravel to the upper water	21 ft.
Gravel in water	35
Blue clay	8
Lower gravel (water)	13
Total	77 ft.

For these well sections we are indebted to Mr. R. R. Rouse, of this city, who is engaged in the business of making tubed wells.

We took the following section of an exposed bluff on Fall creek, at the mill-dam, half a mile above Millersville:

Soil and subsoil	4 ft.
Yellow clay	5
Sand parting	1
Yellow clay, streaked with blue	10
Pale yellow clay	16
Compact dark blue clay to the water line	8
Total	44 ft.

How far the blue clay extends below the bed of the creek we have no means of knowing, as no borings have been made in the vicinity, and the creek no where in this county cuts through the clay to the rock in place.

Several fine exposures of this lower clay occur in the bluffs on the western side of White river, between Broad Ripple and Indianapolis, which afford an excellent opportunity for studying the character of this formation. The lines of deposition are, in places, well marked, but the entire absence of fossils is the most noticeable feature; for the material is well calculated to preserve organic remains. At one point in section 15, township 16, range 3, sixty feet of this clay is exposed, and yet it extends under the bed of the river indefinitely. Returning to the relation of the lower blue clay to the water supply of Marion county in general, and of the city of Indianapolis in particular, it is well to note the fact that the reservoir of water which this impervious bed of clay holds in place in the bowlders below it, has no outlet, except as it rises to the surface through fissures in the clay, and, therefore, can never be exhausted by natural

drainage. To procure it for domestic use it will be necessary to carefully exclude the surface water. To do this requires a tube passed so tightly through the clay as to admit of no transmission of water around it.

The location of Indianapolis—its constantly increasing railroad facilities, its inexhaustible supply of coal at a convenient distance, the near vicinity of great forests of hard wood, and its easy access to the raw material, marks it as a great manufacturing center, at no very distant period in the future. A supply of water for steam purposes, that shall be of easy access, constant and unfailing, is an indispensable requisite to this consumation; and this we have under every acre of land in Marion county. If the city can be supplied with river water, purified by filtration so as to make it potable, it is well; but the population will always have an alternative in the easy access to this lower fountain by tubed wells. Before dismissing this subject, it is well to say that in the clay sections of this county, which embrace all the table lands, there are many places where the upper bed of water-bearing sand is from twenty-five to thirty feet below the surface, and the clay above it is hard and compact. Here a tubed well will supply water of a fair degree of purity; but in an open well it is almost impossible to exclude surface-water when the soil becomes saturated. It will leak in and pass down behind the wall unobserved.

Marion county has no mineral wealth, but in its

CHARACTER OF SOIL

It has the potency and pledge of inexhaustible wealth. Our glacial drift furnishes the material for a soil that answers every agricultural demand. Being formed by the decomposition of almost every variety of rock, it holds the elements of all in such a state of fine division as to give it excellent absorbant properties, and enable it to retain whatever artificial fertilizers may be added. In its natural state the soil of Marion county, generally, has but one prominent defect; the very fine material of which it is made, lying so nearly level, becomes readily saturated with water, and having no means of exit beneath, except by slow percolation through the clay, the water is long retained. This necessitates the escape of a great part of it by

evaporation from the surface, and this, especially in the spring, arrests the warming of the soil and postpones the early preparation of it for the summer crop. This saturation has, also, an unfavorable effect on the vegetable matter in the soil, excluding it from free contact with the air, and thus arresting its rapid decomposition, and often converting it into humic acid, a chemical compound really injurious to crops. In the alluvial, or bottom lands, and in the terrace, or second bottom formations, this objection is relieved by a stratum of gravel or coarse sand a few feet below the surface, which rapidly transmits the water downward and relieves the saturated surface soil. The same effect is produced on the clay uplands by a system of tile drainage. Well-burnt tiles, of proper capacity to carry off the redundant water, sunk to the depth of three or four feet, in lines sixty feet apart, with a good outlet secured, will place even the most tenacious clay soil in a condition very much resembling bottom lands. Indeed, in some respects, well-drained upland is to be preferred to bottom land, as it is not so liable to injury from drouth, and it retains manures much better. The process of tile-draining the level clay lands of Marion county is progressing rapidly, and in a few years the whole county will present a plain of unsurpassed fertility.

WATER-COURSES.

White river has a course of twenty-two miles, on a direct line from its point of entry into the county to its place of exit, but following the meanders of the stream, the distance will be some ten miles greater. By an act of Congress, this stream was declared "navigable" to a point ten miles above the northern line of Marion county. When the white man first built his cabin here, White river was fordable but at a few points in the county, and that only for a short period in the autumn. But, with the change of the country from forests to cultivated fields, the river and its tributaries have undergone a corresponding change. Without assuming that there has been any material decrease in the rainfall, the streams have shrunk in their dimensions till the "navigable river" of the Congress of 1819, has become a mere rivulet a good portion of the year; and its tributaries, Fall creek and Eagle creek, from being mill

streams, furnishing ample power for propelling all needed machinery the year 'round, are now so low during the summer and fall months, as to lose most of their value as mill streams. This shrinkage must be referred to several causes: First, clearing away the forest has greatly increased the evaporation, and a much larger per cent. of the rainfall now goes back into the atmosphere than formerly; second, the streams have been cleared of driftwood and other obstructions, so that the current is more rapid; third, ponds and marshes have been drained, so that these reservoirs, which formerly discharged their stored waters slowly for the whole year, now empty themselves at once, leaving no summer supply; fourth, the tile drainage of a wide extent of country is operating to dry up many of the superficial springs that furnished a summer supply to many brooks and rivulets that were feeders to the larger streams. These causes, operating together, give us more water in our winter and spring freshets, and reduce our streams correspondingly during the dry season.

Though the immediate bed of the principal streams of this county is composed of small bowlders, water-worn pebbles and sand, yet, but a foot below, these will be found resting on the blue clay, which is nearly impervious, so that there is but little loss to our streams by absorption. Though the country is comparatively level, yet the current of our streams is quite rapid. Counting the length of White river on a straight line through the county, it has a descent of nearly two feet per mile, and the fall of Eagle creek and Fall creek exceeds this. If it were not for the tortuous course of these streams they would be torrents. This, however, retards the current considerably, especially in White river, south of Indianapolis.

ARCHÆOLOGY.

We discovered no mounds nor earth-works indicating the residence of a prehistoric race in the territory now comprised in Marion county, though flint arrow heads, stone hatchets, chisels, and other tools of the ancient Stone age, are frequently found in the surface soil. This is especially the case in the southern part of the county, in the neighborhood of Glen's Valley. Many of these stone implements, or ornaments, are

made of talcose slate, a rock not found nearer to this locality than the Cumberland mountains, or the regions of Lake Superior, and many of these are of curious form, and if of use, we have not been able to discover what that use was.

The Delaware Indians had two towns in this county when first visited by the white man. The largest and most important of these was located on the high bluff west of White river, the town being divided by the line now separating Johnson and Marion counties. The inhabitants cultivated an island of some two hundred acres, immediately east of the town. This town was the residence of the Delaware chief, Big Fire, who was known as a firm friend of Governor Harrison and the white pioneers of this territory. Indeed, it was a dispute about the right of Big Fire to sell to the General Government a strip of land south of a line known, in early days, as the Boundary, that led to the hostility of the Miami and Shawnee Indians in 1811. It was this White river town that the Madison Rangers destroyed, in the fall of 1812, in revenge for the massacre of Pigeon Roost, in Scott county, perpetrated by a band of Shawnee warriors. This sad and unfortunate mistake in not discriminating between the innocent and the guilty, cost Governor Harrison no little trouble in convincing Big Fire that it was a mistake of the Rangers, to be attributed to their ignorance of the geography of the country. But few marks remain to identify the spot where once stood the most populous of the Delaware towns.

The other Indian village was located in the great bend on the east side of White river, in section 20, range 4, township 17. The location of the village, and the chief part of its cultivated ground, is now a forest of sixty years growth, and nothing but the tradition of the "Old Settlers" fixes the location of the town. A large spring breaks out at the foot of a hill bordering a piece of elevated bottom land, from eighty to one hundred rods wide. Around this spring the wigwams were built, and on the bottom land the squaws cultivated the corn, beans and pumpkins that served as a relish to the venison of the hunter. Near the river is an ancient cemetery, where the bones of many generations of hunters and warriors repose, except when the river encroaches on their resting place and exposes their re-

mains, which it frequently does. Last spring a freshet uncovered several pits, or ovens, excavated in a very compact clay, near this burying ground. They were about thirty inches in diameter and about the same depth. They had been burned till the inner surface was as hard as a brick. At the bottom of these pits were found coals and ashes, and around them were several fragments of pottery. This was probably a very old town.

NATURAL HISTORY.

The Botany of Marion county presents nothing peculiar. It was originally covered with a heavy forest of hard wood, among which not a single evergreen was found. On the undulating uplands the prevailing species were the Sugar Maple; White, or Gray Ash; Blue Ash; Black Walnut; Red Beech; Butternut; White Oak; Poplar, (*L. Tulipifera*); Wild Cherry, etc. On the flat uplands the timber consisted chiefly of Bur Oak; White Elm; Shellbark Hickory; White Beech; Water Ash; Red, or Soft Maple, etc. The alluvial and terrace lands (first and second bottoms) were covered with large trees of Black Walnut; Blue Ash; Hackberry; Buckeye; Sycamore; with abundance of grape vines, which often climbed to the top of the tallest trees. Beneath these forests there grew a dense mass of shrubbery, consisting chiefly of Spicewood; Paw-paw; Waahoo; Black Haw; Leatherwood; Prickly Ash, etc. In every place where the forest and shrubbery were sufficiently open to admit a glimpse of sunshine, the ground was covered with nettles, matted together with pea vines. Such was the primitive condition of this county when the "Red Man" hunted the deer here; but it is remembered only by a few surviving pioneers. The forests have dwindled down to a few patches of woodland, surrounded by cultivated fields; the undergrowth has entirely disappeared, and the nettles and pea-vines are botanical curiosities. A few spots have been preserved in their primitive wildness by those who love to remember the scenes of pioneer life, but even these will soon disappear.

Marion county once abounded in wild game, and the streams were well stocked with fish of all the varieties usually found in western waters. The Black Bear, the Gray and Black Wolf, Buffalo, the Deer, Raccoon, Fox, Gray and Fox-Squirrels, etc.

Wild Turkeys and Pheasants were abundant, and the woods were vocal with the songs of birds. It was indeed the paradise of hunters—but all these have disappeared; a few timid quails only, lead a precarious life, protected by stringent laws and the vigilance of farmers. The birds of song are nearly exterminated and their mellow notes superseded by the harsh screak of the English sparrow. The abundance of fish, for which White river and its tributaries were once noted, has greatly diminished, and would, perhaps, have entirely disappeared but for the protection of law and the watchful care of citizens who are personally interested in the enforcement of these laws.

We subjoin the following ideal section of the geology of Marion county, drawn from natural sections, borings and excavations made in various parts of the county. Beginning with the most recent formations, we have—

Transported Material.

1. Alluvium, or bottom land.....from 10 to 20 feet.
2. Terrace formations, gravel and sand.....from 50 to 100 feet.
3. True bowlder clay (glacial).....from 40 to 110 feet.
4. Blue sedimentary clay and sand.....from 20 to 120 feet.
5. Bowlders and gravel .....from 5 to 15 feet.

Rock in Place.

6. Knob sandstone (Carboniferous)..... ..... 25 feet.
7. Genessee Slate (Devonian)..... 80 feet.
8. Corniferous limestone (Devonian)..... 50 feet.

The Corniferous limestone has been penetrated 50 feet, but its entire thickness at this point is undetermined, as its eastern out-crop is concealed by the heavy drift deposit. Numbers 1, 2, 6 and 7 underlie only portions of the county; the other members are general in their distribution.